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A Geographic Index of Physician Practice Costs

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ABSTRACT

This paper develops a geographic index of physician practice costs. A Laspeyres index is derived for each Metropolitan Statistical Area and for the nonmetropolitan portion of each state. Relative prices by area are obtained for four practice inputs: physicians' own time, employee wages, office rents, and malpractice insurance. Each input price proxy is weighted by the share of physician gross revenues spent on that input. The index is useful in explaining geographic variation in physician fees. It may be used in reforming the way Medicare pays physicians.

I. INTRODUCTION

The federal Medicare program purchases approximately 21 percent of physician services in the United States, measured as a share of revenue (Waldo, Levit, and Lazenby, 1986). Medicare pays physicians their charges for specific services constrained by their customary charge and the 75th percentile of area charges for each service (the "prevailing" charge). Since 1975, the rate of increase in prevailing charges has been limited by the growth in an index of physician practice costs, the Medicare Economic Index (MEI) (Dutton and McMenamin, 1981). This "customary, prevailing, and reasonable" method of reimbursing physicians has resulted in an inter-procedure and inter-area pattern of fees that may be unrelated to the cost of providing these services.

Concern over inequities in physician fees for different procedures and in different areas, together with the rapid growth in Medicare's expenditures for physician services, is prompting consideration of reforms in the way physicians are paid. Many of these proposals center on bringing payments more in line with the relative cost of providing services. Regulators of other industries often set prices equal to some measure of costs in the hope that the regulated market outcomes will possess the desirable resource allocation properties of a competitive equilibrium (Kahn, 1987). The regulatory approach that has drawn the most attention would have payments reflect costs by basing Medicare rates on a resource-based relative value scale (RVS) for different procedures (Hsiao et al., 1987).

However, any payment reform will need to recognize that a physician's cost of providing services varies not only from procedure to procedure but also from area to area. Practice inputs—employee time and office space, for example

—are bought in local markets. Furthermore, a physician's cost of locating in an area depends on the local cost of living and the area's amenities. Failure to reflect relative geographic costs in reimbursement rates could create serious resource misallocation; namely, a physician oversupply in areas where fees are high relative to costs and an undersupply where fees are low relative to costs.

Policymakers—particularly those in Congress—have indicated that physician payment reforms should reflect geographic differences in practice costs. Unfortunately, there exists no mechanism for comparing practice costs in different areas of the country. To remedy this situation, we develop a geographic index of practice costs that captures exogeneous variation in input prices across distinct markets—termed the Geographic Medicare Economic Index (GMEI).

In the following section, we consider conceptual issues related to index form, area definitions, and the measurement of the relative cost of physician time. Section III discusses the computation of practice cost shares and geographic input price relatives from available data sources. Actual index values are presented in Section IV, with our results reviewed for plausibility.

II. CONCEPTUAL FRAMEWORK

A. Index Structure

A geographic cost of practice index should measure the relative cost of providing the same physician services in different areas. If the minimum cost at which a physician can provide services Q when he or she faces prices P for practice inputs is denoted by C(Q, P), a cost of practice index[1] is defined as

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[1] See Deaton and Mullbauer (1980) for a discussion of cost indices.

$$I(Q, P_1, P_0) = C(Q, P_1)/C(Q, P_0) \qquad (1)$$

where P_i is the vector of practice input prices in area i, and $I(S, P_1, P_0)$ is the cost index, which in general depends on the output Q as well as the input prices P_1 and P_0.

This cost index could be computed in several ways. Equation (1) suggests taking the ratio of observed practice costs in different areas. This method yields valid cost comparisons only if physicians provide the same services across areas. While several physician surveys measure practice costs by region, they do not adequately allow geographic differences in volume, casemix, specialty mix, practice style, efficiency, and quality or intensity of care to be held constant.

If physician charges are closely related to costs, the ratio of charges for the same service in different areas could be used as a proxy for the cost index. Physician charges are only a good indicator of differences in costs across markets when the markets are competitive. However, areas differ in market characteristics (such as the extent of insurance coverage, per capita income, physician supply, and competitiveness), in the definition of procedures,[2] and in the relationship between stated charges and true transaction prices.[3] Moreover, since a primary purpose of ours is to construct an independent measure of costs to assist regulators in establishing the appropriate variation in charges, using charges to measure costs is inappropriate.

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[2] Areas differ in the extent of services bundled into the charge for a procedure (e.g., pre- and post- operative visits) (Mitchell, 1987), in coding practices (especially for office visits), and in the intensity of services provided under a given procedure code.

[3] Transaction prices differ from stated charges due to discounting and bad debts, which vary among areas.

The economic theory of index numbers (see Manser and McDonald, 1988, or Diewert, 1976, for a review) demonstrates that the cost index (1) also can be calculated from relative input prices and shares of practice inputs in total costs. This result implies that the index (1) can be computed without having to measure output or estimate the parameters of the production or cost function. However, a specific functional form for the production/cost structure must be assumed.

The appropriate form for an index number depends on the underlying production technology. In Diewert's (1976) terminology, a price index $I(P_1,P_0)$ is "exact" for a production function with dual unit cost function $C(P)$ if $I(P_1,P_0) = C(P_1)/C(P_0)$. The Laspeyres index can be written as

$$I_L = \sum_j (CS_{0j}) \cdot P_{1j}/P_{0j} \qquad (2)$$

where

I_L = the Laspeyres index for areas 1 and 0;
CS_{0j} = the share of the jth input in total costs in area 0;
P_{ij} = the price of the jth input in the ith area.

This is exact for the Leontief technology, which presumes no substitution among inputs. It can be shown (Diewert, 1976) that the geometric index

$$\ln(I_g) = \sum_i (CS_j) \cdot \ln(P_{ij}/P_{0j}) \qquad (3)$$

where

I_g = the geometric index for areas 1 and 0, and "ln" indicates that the natural logarithm is taken,

is exact for the Cobb-Douglas technology, which allows a moderate degree of substitution (an elasticity of substitution of one) among inputs.

Diewert (1976) defined a price index to be "superlative" if it is exact for a unit cost function which is capable of providing a second-order approximation to an arbitrary linearly homogeneous unit cost function. One well-known "flexible" cost/production technology is the translog functional form. Christensen, Jorgenson, and Lau (1973) show that the translog structure provides a second-order approximation to a technology with arbitrary substitution possibilities. Diewert (1976) and Caves, Christensen, and Diewert (1982) show that the Tornqvist index is exact for the translog cost function. This index is calculated as

$$\ln(I_t) = \sum_j (1/2) \cdot (CS_{1j} + CS_{0j}) \cdot \ln(P_{1j}/P_{0j}) \tag{4}$$

where

I_t = the Tornqvist index for areas 1 and 0, and

CS_{ij} = the cost share of the jth input in the ith area.

The Tornqvist index is identical to the geometric index except that, instead of a single cost share for each input in all areas, the cost shares in the two areas being compared are averaged. The cost share variation reflects input substitution in response to relative input price differences.

We chose the Laspeyres index number form for the GMEI. The Laspeyres index compares the cost of purchasing an identical market basket of inputs in different areas, measuring only the exogeneous input price variation faced by physicians, not differences in input utilization due to output or efficiency variations. The Laspeyres GMEI for area j can be written as

$$GMEI_j = \sum_i \frac{p_{ij}}{p_{in}} \quad \frac{p_{in}\, q_{in}}{\sum_i p_{in}\, q_{in}} \tag{5}$$

where p and q represent input prices and quantities for each of the i inputs included in the index, and the subscript n denotes national average values. The term on the left is the local price of input i relative to the national average price. The term on the right is the input weight, that is, the national average cost share (expenses as a proportion of total practice costs) for input i.

We believe the Laspeyres form has several compelling advantages. One is ease of computation. The Laspeyres index can be calculated with national practice input cost shares, while an alternative, such as the Tornqvist, requires cost shares area by area, greatly multiplying data requirements. Moreover, area differences in cost shares may not be reflecting input substitution, as the theory assumes. Cost shares may vary because of output or efficiency differences, factors that would be inappropriate to capture in an input price index. In addition,the Laspeyres form is widely used, accepted, and understood, which are important advantages for an index which may be used in public policy.

As is well known, the potential for substitution bias is a major criticism of the Laspeyres form. However, employing an index that does not allow for input substitution is less restrictive as the elasticity of substitution among physician practice inputs and relative input price differences among areas are smaller. We use broad input categories in the GMEI—for instance, employees, office space, and malpractice insurance—which are not easily substituted. Moreover, the majority of physician practice inputs are composed of labor—physician and employee time—whose prices are highly correlated among areas. Both these factors suggest a small substitution bias in a Laspeyres GMEI.

Studies of other Laspeyres indices—both intertemporal and cross-geographic—have not found substitution bias to be empirically significant. Berry (1981) concluded that using a Laspeyres index produced little substitution bias in the MEI. Sherwood (1975) calculated the BLS Family Budgets (an inter-city cost-of-living index) using both fixed and variable weight index forms and found that differences among areas were stable. Braithwaite (1980) concluded that the Consumer Price Index overstated the rate of inflation from 1958 to 1973 by only 0.1 percent annually as a result of employing a fixed-weight structure. Manser and McDonald (1988) found a similarly small substitution bias in the CPI of 0.18 percent per year from 1959 to 1985. Pope (1989) calculated both Laspeyres and geometric index forms of the Medicare Prospective Payment System hospital wage index, which differed by only 0.1 percent on average. All these studies suggest that substitution bias is unlikely to introduce serious distortions into the GMEI.

In general, the cost of practice index (equation (1)) depends on output Q as well as input prices P. Ideally, GMEIs would be calculated for each physician output to reflect differences in the input proportions used to provide them. Since no data exist on input combinations for all the procedures physicians perform, distinct indices cannot be calculated for each procedure. We did compute specialty-specific indices based on specialty cost shares, which at least partially capture differences among physician outputs.[4]

B. Area Definitions

Data availability aside, GMEI areas should be defined with the following considerations in mind. First, input prices should be fairly homogeneous within an area, so that it can be reasonably assumed that all physicians within an area face the same set of input prices. Second, to minimize border-crossing, the areas should be fairly self-contained markets for practice inputs. That is, physicians whose offices are in an area with a low index but close to an area with a high index should not have the incentive to move their offices across the boundary. Finally, to facilitate policy adoption, the areas selected for the GMEI should be compatible with current administrative practices.

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[4] The specialty-specific indices differ little from the all-specialty index. See Zuckerman, Welch, and Pope (1988) for the comparisons.

Although the first criterion encourages defining small areas such as counties, employing small areas in the GMEI may impose arbitrary divisions of input markets. This could create opportunities for physicians to "game" the system by locating their practices in high-cost areas but buying as many inputs as possible from lower-cost contiguous markets. Larger areas such as states or regions would limit border-crossing opportunities but would have more heterogeneous input prices, leading to intra-area inequities among physicians if high-cost and low-cost markets are pooled together.

While no geographic entity is a perfectly self-contained market for practice inputs, some are better than others. The first criterion leads us to dismiss national subdivisions such as census regions, census divisions, states, or carrier areas as too large to effectively distinguish among input markets. In fact, these areas might exhibit more cost variation within their borders than across their borders. The second criterion leads us to dismiss areas as small as a county to avoid creating incentives for border-crossing. In selecting GMEI areas, some middle ground is needed.

The Metropolitan Statistical Area (MSA) fills this gap. As defined by the Census Bureau, MSAs are aggregations of adjacent counties that have a close economic and social relationship. The MSA is large enough to enable most physicians to purchase all of their inputs within the MSA and yet is homogeneous enough to reflect a uniform set of prices. Because MSA boundaries are typically in low-density areas, border-crossing is unlikely to be a serious problem. Physicians in nonmetropolitan communities could be grouped into non-MSA areas on a state-by-state basis. The prospective payment system for hospitals (PPS) uses metropolitan areas and nonmetropolitan areas of states to adjust for wages, facilitating the use of such areas for physician payment.

Within MSAs, rents and wages tend to be higher in the urban core than in the suburban ring (Abt Associates, 1987). By virtue of being smaller, cores and rings would probably be more homogeneous in terms of input prices, but would have more boundary problems, albeit to a lesser extent than counties. It might be possible to derive a somewhat more refined set of GMEI areas from the basic MSA (Welch, 1989). However, because the notion of varying Medicare payments by core and ring is not incorporated in the present CPR approach, this approach is likely to create administrative problems.

One geographical area that would be administratively easy to implement is the prevailing charge locality. Medicare carriers have already defined areas to compute prevailing charges for physicians, and these could be used for a geographic index. However, the definition of these areas varies considerably among states: Eighteen states have a single prevailing charge statewide. Twelve have major contiguous areas, including both rural and urban in the same cell. Seven states have separate cells for each major city, and fourteen have an urban cell and a rural cell or have cells incorporating several cities of similar size. The extant areas for physician charges are derived from no common principle and, therefore, should not be used as the basis of a nationwide index.

Taking the three basic criteria into account, it seems best to use the MSAs and state nonmetropolitan areas as the basis for defining the GMEI. This choice is not only appropriate on conceptual grounds, but would also facilitate the application of available data sources.

C. Physicians' Own Time

Physicians' own time is unlike other inputs. The high degree of self-employment among physicians implies that the costs of their own services are not easily associated with market prices. In addition, since about 54 percent of the revenues generated by a practice are paid to the physician as net income, physicians' own time is by far the largest cost category. Geographic variation in its relative price is likely to dominate other factors in the GMEI.

The basic reason for acknowledging area cost differences in physicians' time is to compensate physicians at the same real rate across the nation. An area's real rate of compensation can be thought of as the ratio of the nominal payment to the area's costs. These costs have two basic components--pecuniary and nonpecuniary. Variations in the pecuniary component are represented by differences in basic cost-of-living elements such as housing, food, fuel, and transportation. The nonpecuniary component differs across areas due to professional factors such as access to quality colleagues and the presence of modern hospitals and medical technologies, and due to personal factors such as availability of good schools, proximity to cultural events, and clean air.

Physicians may choose to practice in an area with high cost of living because of the area's amenities. In the same sense, physicians may shun lower cost-of-living areas if these areas create professional isolation or other personal compromises.[5] Unless nominal payments are adjusted by area cost differentials, real payments will vary across locations. Therefore, in the interest of creating an equitable compensation system, nominal payment for own-time costs should be higher in high-cost areas.

Although cost-of-living is an intuitively appealing measure of the costs of physicians' own time for the GMEI, introducing nonpecuniary factors highlights the potential inequities that would result were physicians fully compensated for cost-of-living differences. Higher (lower) costs of living tend to be offset by greater (lesser) access to amenities. Consider two cities with initially the same nominal wage, same cost of living, but different level of amenities. As spatial equilibrium evolves, workers would move to the city with greater amenities, bidding down nominal wages and bidding up the prices of immobile goods such as land and housing. The city with greater amenities would end up with greater cost of living, and payment based on cost of living would overpay physicians locating there.[6] In spatial equilibrium, the marginal physician would be indifferent with respect to the area in which he/she locates.

To expand on the nature of this equilibriating process, we posit a stylized model of physician production and labor supply in an appendix to this paper. In this model, physician utility depends on income (adjusted for cost-of-living differences), leisure, and area amenities. We show formally that if prices for physicians' services are market-determined, a necessary condition for spatial equilibrium is that the physician's implicit wage (adjusted for cost of living) is lower in areas with greater amenities. Furthermore, we show that if this implicit wage is included in a Laspeyres index of practice input costs, the input index can be used to establish the same relative prices as a market would determine, under certain conditions.

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[5] In a study of physician location, Newhouse et al. (1982) found that physicians in cities of one million or more earn less per hour in real terms than do their colleagues in smaller cities and towns. This is consistent with the marginal physician preferring to live in a larger metropolitan area.

[6] See Roback (1988, 1982) for general equilibrium models of wages and cost-of-living as equalizing differences for amenity differences.

In reality, prices for physician services are not purely market-determined, but are constrained or set by third-party insurers in many cases. If prices are rigid, spatial equilibrium must occur through changes in hours worked. Suppose insurers administratively set fees that are rigid and that imperfectly reflect geographic differences that would have existed in the market in the absence of insurance. The supply of physician hours would be curtailed relative to a free market in areas in which prices were set below market prices, assuming a positively sloped physician labor supply curve. On the other hand, high-price areas might find physicians willing to expand hours worked. As long as this labor supply response is feasible, utility will be higher in areas where prices are higher.

In the long run, however, physicians will migrate from low- to high-price areas. Since prices and implicit wages are fixed, hours worked per physician in the high-price area will necessarily fall. This occurs because total patient demand is given once the price is set by insurers. The utility advantage of the high-price area will gradually erode as hours reductions cut real incomes and spatial equilibrium is established. Real annual incomes, though, need not be equal across areas. Therefore, spatial equilibrium in the face of administratively set fees may involve substantial variation in hours worked.

The most promising empirical approach to capturing cost-of-living and amenity differences among areas is to use data on nominal earnings.[7] Workers will locate in higher cost-of-living areas only if they earn more. Conversely, they will accept lower wages to locate in high-amenity areas. If workers move to eliminate any differences in their utility among areas, observed (hourly) earnings provide the correct compensating differentials for cost-of-living and amenities.

Empirical studies of regional wage differences confirm that earnings vary to reflect both cost-of-living and amenities (Carlino, 1986). The most recent and comprehensive studies have found that when amenities are accounted for, real wages are equal, or nearly so, across regions. For example, Roback (1988) concludes that when amenities are held constant, "there is little left of the regional [real] earnings differences." Roback (1982) found that "regional differences in earnings can be largely accounted for by regional differences in local amenities". Gerking and Weirick (1983) found that controlling for cost of living, worker characteristics, and amenities, workers "have approximately the same pay rates no matter where they live." Smith (1983) concluded that "our estimates using microlevel data provide substantial support for a role for site amenities in determining real wage rates." Getz and Huang (1978) found that "cost-of-living, human capital, and environmental goods explain a high proportion of the variation in earnings across cities [about 75 percent]". Getz and Huang's results show that cost of living is reflected one-for-one in wage rates, ceteris paribus, demonstrating that the nominal wage rate can be used as a proxy for both amenities and cost of living.

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[7] Another approach might be to adjust area cost-of-living data by some factor that acknowledges differences in amenities. However, the difficulties inherent in quantifying amenities and the limited amount of cost-of-living data suggest that other avenues need to be explored. Zuckerman, Welch, and Pope (1988) evaluates available cost-of-living data. The government does not produce a geographic COL index. Several private sources exist, but we believe that they are too unreliable to consider for use in public policy.

Physicians' hourly net incomes by area is an obvious income-based proxy for physicians' time costs. However, for the GMEI, physicians' earnings has three basic problems: First, using income differentials to adjust Medicare fees would be circular, because the incomes are determined, in large part, by the fees. Medicare pays 21 percent of the expenditures for physician services (Waldo, Levit, and Lazenby, 1986). This contrasts with using area data on office rents, which are determined by a market of which physicians are a small proportion. This problem of endogenity would grow to the extent that Medicaid and private insurers use any geographic index that Medicare might implement.

Second, area variation in third-party coverage and payment levels have distorted income patterns, so that they diverge from true differences in relative own-time cost across areas. If fees are set or constrained by insurers at non-market levels, physicians' hourly net earnings do not provide the correct compensating differential for area cost of living and amenities (see Appendix 1). Finally, differences in the degree of consumer ignorance and competition with respect to medical services could lead to differences in physicians' utilization patterns that are unrelated to the value of their time. For these reasons, data on physician income would not be appropriate to capture variation in own-time costs.

An alternative is to use earnings differentials of a nonphysician occupational group to serve as a proxy for physicians' own-time costs. The proxy group should have the following characteristics: There must be reason to believe that physicians and this group consume similar goods and services and have similar preferences regarding amenities. Otherwise, differences in cost of living and amenities will have different meanings for physicians and the proxy occupational group. The occupational group, as defined, must be homogeneous over areas, so that variations in its nominal income do not reflect variations in the composition of the group. For instance, workers in service industries could mean low-paid hotel workers in one location and high-paid interior decorators in another location. The group should be geographically mobile. If the proxy group is not mobile, their marginal utility may not equate across areas. In that case, their earnings would not measure the correct compensating differentials for cost-of-living and amenity variations. Finally, the earnings of the proxy occupational group should be determined largely in a competitive market. Government employees and workers with a high degree of unionization, therefore, might not be appropriate proxy groups.

All these criteria point to professional workers as a potential proxy occupational group. We expect that they have similar preferences and purchase similar goods and services as physicians, are geographically mobile, and have earnings that are subject to market forces.[8] Since a high level of education is a key characteristic of physicians, the comparability of this occupational group to physicians can be improved if it is restricted to professionals with some graduate (i.e., post-college) education. This reduces the heterogeneity of workers in the proxy group. Studies of geographic wage differentials (cited above) have found that cost-of-living and amenity-adjusted wages are equal across areas only for workers with similar human capital characteristics. These studies control for a large vector of human capital attributes through

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8. Even if the underlying distribution of valuation of amenities were the same for physicians and other professionals, variation in the relative demand for these occupations across areas could produce differences in the actual valuation of amenities (as reflected in earnings) by the marginal worker. This could weaken the justification for using professionals as a proxy group for physicians. However, the extent to which the geographic distribution of physicians differs appreciably from that of other highly-educated professionals is not well established.

multiple regression. Restricting the proxy group to the highly educated accomplishes much the same thing. Many human capital characteristics are highly correlated with educational attainment.

III. COST SHARES AND INPUT PRICES

A. Cost Shares

The weights in the GMEI are equal to the proportion of total physician practice revenues accounted for by each input. Although it is possible to state a number of criteria for aggregation of physician inputs into GMEI categories, in practice, index categories are limited by available cost share data. Cost shares can be computed from either of two national physician surveys. One data source is the 1984-85 Physicians' Practice Costs and Income Survey (PPCIS), a national telephone survey of physicians conducted for the Health Care Financing Administration (Sprachman et al., 1985). Gross and net income for 1983 were collected, together with the practice cost components of employee wages and fringe benefits, office space costs, equipment costs, medical supplies costs, and malpractice insurance premiums.

An alternative data set is the American Medical Association's (AMA) Socioeconomic Monitoring System (SMS). Results from this survey are published annually in the AMA's Socioeconomic Characteristics of Medical Practice. The 1983, 1985, and 1987 AMA shares for self-employed physicians are presented along with the comparable (1983) PPCIS shares in Table 1. The shares are generally similar, but there are some differences due to the wordings of the PPCIS and AMA questionnaires. These are highlighted elsewhere (Zuckerman, Welch, and Pope, 1988). Although AMA and PPCIS cost shares for physicians' own time, employee wages, and rent differ, the associated price proxies are highly

Table 1

Input Cost Shares: 1983, 1985, 1987

	Net Income[a]	Non-Physician Employee Wages	Office Rent	Mal-Practice Insurance	Medical Supplies	Medical Equipment	Other
PPCIS							
1983	58.2	17.9	5.4	4.4	5.1	2.1	6.9
AMA							
1983	57.4	14.5	10.4	3.5	4.6	2.5	7.1
1985	54.9	15.4	11.4	4.5	4.8	2.6	6.5
1987	54.2	15.7	11.1	5.6	5.0	2.4	6.0

Source: HCFA-NORC Physicians Practice Costs and Income Survey, 1983-1984; American Medical Asssociation, Socioeconomic Characteristics of Medical Practice, 1984, 1986, and 1988.

a. This will serve as the weight for physicians' own time.

correlated. Therefore, in terms of their empirical impact on the GMEI, there is no appreciable distinction between the AMA and PPCIS data. We chose to use the most recent AMA cost shares (1987) because the AMA data are annually updated and because they are more internally consistent than the PPCIS data (i.e., the individual components sum to total costs more frequently in the AMA data than in the PPCIS data).

B. Input Prices

Our review of available data uncovered no information on geographic differences in the prices of medical supplies and equipment. Anecdotal evidence suggests that price variation in these inputs is minimal. In computing the GMEI, we assume that the costs of these inputs and the residual category "other" are the same in all areas. Since only about 13 percent of total practice revenues are accounted for by these inputs, our approach captures the bulk of the variation in practice input prices.

1. Physicians' Own Time

Instead of measuring area differences in the actual nominal income of physicians, we wish to measure area differences in nominal income that would correctly compensate physicians for differences in both cost of living and amenities. The 1980 Census of Population and Housing is the best source of area-specific income data for professionals.[9] It is updated only every 10 years, but geographic relative wages are unlikely to change significantly over a decade. From it we can compute median hourly and annual earnings (including wage and self-employment income) within major occupational groups across MSAs and rural areas of states. The most relevant occupational group for the GMEI is "Professional Specialty Occupations." It includes physicians, as well as engineers, lawyers, and scientists, who might reasonably be viewed as having preferences similar to physicians. It also includes occupations such as athletes, teachers, and social workers, whose preferences are less clearly similar to those of physicians.

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[9] Our report on file with NTIS considered several alternative sources. Primary among these, the Current Population Survey has more current data similar to the Census but is based on a much smaller sample. The Bureau of Labor Statistics' Area Wage Survey does not have wages for any professional groups and is limited to 70 MSAs.

We compute 1979 area earnings differentials of professional specialty occupations excluding physicians from the 20 percent sample of the 1980 Census. Medians are used to measure each area's earnings because they are less influenced by extreme values than are means. In addition, we use hourly as opposed to annual earnings since, conceptually, we are measuring cost per unit of time. Workers were assigned to areas based on their place of work, not their place of residence. This removes biases created by commuting patterns. Higher-income professionals working in certain MSAs live outside of the MSA, while lower-income professionals reside within the area. For example, commuting from the Nassau-Suffolk MSA to the New York City MSA biases up place-of-residence index values for the former relative to the latter.

The types of occupations represented in professional specialty workers are not identical in all areas. For instance, Huntsville, Alabama, a small MSA with a major National Aeronautics and Space Administration (NASA) facility, has a disproportionate share of engineers. Because engineers as a group are paid more than the average professional, not adjusting for occupation mix would inappropriately increase the median for Huntsville. Conversely, preponderance of a lower-income occupation, such as teachers, in an area would inappropriately lower the area's proxy.

To correct for occupation mix, we computed an occupation-adjusted proxy:

$$P_i = \sum_j \frac{M_{ij}}{M_j} w_j$$

where M_{ij} is the median earnings in area i of occupational group j, M_j is the national median for occupation j, and w_j is the group's weight. We weighted each group's median earnings by its share of national professional earnings (as derived from the 1980 Census data). The specific subgroup occupations are determined by the standard occupational classifications (SOC) used by the Census Bureau and the available sample sizes.

The occupation adjustment yields plausible improvements. One would expect an occupation adjustment to lower the proxy the most in areas with a disproportionate concentration of, say, engineers and natural scientists: Huntsville, Alabama, as mentioned, has a large NASA facility, Melbourne-Titusville, Florida, the Cape Kennedy Space Center and Poughkeepsie, New York a major IBM plant. For these areas, the occupation adjustment reduced relative professional earnings by 16, 14, and 12 percent, respectively.

One potential source of distortion that is not eliminated by the occupation-mix adjustment is intra-occupation heterogeneity. For instance, an attorney in New York City might be a specialist in corporate tax law, while one in rural Kansas might deal with more general types of cases. However, since we use median earnings, it is not necessary that all workers within an occupation be similar among areas, only that the median-earning workers are. Further, we limit the sample to those with at least five years of college education to reduce intra-occupation heterogeneity and improve comparability to physicians. However, our empirical analysis shows that including all professionals would not significantly alter the price proxy. Even after our place of work, occupation mix and education adjustments, industry mix, unionization, firm size, or other potential area-specific differences may still be reflected in the earnings data.

2. Nonphysician Employee Wages

Aside from physician time, the largest component of the GMEI is employee comprehensive, occupationally detailed, and has a sufficiently large sample size to construct accurate wage indices.[10] To calculate the employee price proxy, we used median 1979 hourly earnings of the following occupational categories: Administrative support occupations (including clerical); Registered nurses; Licensed practical nurses; and Health technologists and technicians (excluding LPNs).

To reflect the occupation mix in physicians' offices, hourly earnings are weighted by each occupation's share of physician expenditures for employees. The expenditure shares were estimated from PPCIS survey counts of physician employees and Census earnings data by occupation. We estimate that 60.4 percent of physician employee expenditures are for clerical workers, 20.4 percent are for RNs, 6.9 percent are for LPNs and 12.3 percent are for health technicians. The weighted hourly earnings normalized to have a national mean of one constitute the nonphysician employee price proxy for each MSA and state rural area.

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[10] Two alternative sources of data on earnings of employees in physician offices are from unemployment insurance (UI) and Federal Insurance Contribution Act (FICA) reports. Neither source distinguishes full-time from part-time employees and both appear to include physicians who, although effectively self-employed, are technically employees of their practices' professional corporation. Another source is the hospital wage index used in Medicare's prospective payment system. Although overcoming the above problems, the occupation mix of workers varies considerably between hospitals and physician offices, with the latter hiring a much larger proportion of clerical staff.

3. Office Rents

Although there are no data on rental rates for physician office space in different locations, apartment rent data are available. The U.S. Department of Housing and Urban Development (HUD) derives a "fair market rent" for all areas with a Section 8 housing assistance program. These data are published annually in the Federal Register and represent the 45th percentile rent for various sized units in each geographic market. HUD uses 1980 Census or American Housing Survey data updated to the current year (in this case, 1987) with the CPI. These "fair market rents" are used in the computation of the Section 8 rental subsidy. A key advantage of this price information is its availability for all MSAs and rural counties.

A weakness of this proxy is that physician offices are in commercial as well as in residential buildings. Unfortunately, we could find neither data on the proportion of physician offices in each type of building nor statistical evidence on how closely residential and commercial rents track each other across areas. However, residential and commercial rents are likely to be correlated at the metropolitan-area level because the same factors—such as density, construction costs, in- or out-migration, and income—affect both.[11] Clearly one cannot speak of two separate markets, in part because residential units are sometimes converted into commercial units and vice-versa. While the exact relationship between housing rents and physician office rents is unknown, the fact that the MEI uses the housing component of the CPI as a proxy for changes in office rents suggests that Fair Market Rents are a viable proxy in the GMEI.[12]

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[11] One factor that creates divergence between residential and commercial rents is residential rent control. Rent control may cause some bias in our proxy in certain areas, e.g., New York City.

4. Malpractice Insurance Premiums

Although no single data source presents malpractice insurance premiums for all specialties and insurance jurisdictions, such data can be compiled from a survey of a small number of major insurers at relatively low cost. The Health Care Financing administration conducts such a survey annually. The pricing area for malpractice insurance is typically a state, such that premiums are not defined uniquely for each GMEI area. In those states with multiple pricing areas, we have recognized intra-state variation in our measure of relative premiums. For most states, the source of premium information is the St. Paul Fire and Marine Insurance Company, the nation's largest medical malpractice insurer. In states where this insurer does not have one of the top three market shares, other companies' rates were used.

To be comparable across areas, premiums must apply to a standardized policy. Our premium data apply to mature claims-made insurance, which covers all claims brought during the policy and any preceding year that the physician was insured by the same company.[13] The standardized policy has a maximum liability coverage of $100,000 per claim and $300,000 per year.

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[12] An area construction cost index, such as HCFA has studied for paying hospital capital costs under the prospective payment system, is an alternative proxy. However, it ignores other operating expenses and market demand conditions for office space which have a major influence on rents. This proxy is less desirable than credible rental data.

[13] Occurrence insurance, on the other hand, protects against claims resulting from a potential act of malpractice in the policy year, no matter when the claim is brought. In general, claims-made premiums are lower than occurrence premiums, holding constant the level of coverage.

Malpractice premiums vary by specialty, so premiums must be standardized for specialty. We chose three specialties that represent the range of malpractice risk: general practitioners who do not do surgery (representative of all low-risk specialties), general surgeons (a moderate-risk group), and orthopedic surgeons (a high-risk group). The three premiums were weighted using the share of Medicare physician spending accounted for by each risk class: general practitioner's premium, 0.55; general surgeon's premium, 0.33; and orthopedist's premium, 0.12 (Burney and Schieber, 1985). This procedure yields premiums for 1985 and 1986 for each area, which, when normalized, is a relative price proxy. These relative prices vary across areas between 1985 and 1986. Since there is no a priori reason to believe that one year is more representative of equilibrium prices than the other, we have used a simple average of the price relatives in the index that follows.

IV. RESULTS

Table 2 presents a set of descriptive statistics for each of the price proxies and our basic GMEI. To provide a sense of the dispersion in the data across MSAs and state rural areas, we show selected percentiles and the standard deviations, both weighted by area population, as well as the maximum and minimum values. Recall that the Laspeyres structure described above requires that each price enter the index normalized relative to the base price. All price proxy data presented here have been normalized relative to a population-weighted national average price.

The data show that malpractice premiums vary the most across geographic areas. Physicians in the state with the highest premiums—New York—pay over seven times more for a $100,000/$300,000 mature claims-made policy than do

Table 2

Input Price Proxies: Percentiles and Standard Deviations

(1.00 = U.S. average)

	Physicians' Own Time	Employee Wages	Office Rent	Malpractice Insurance	GMEI
Percentiles					
Maximum	1.49	1.45	1.73	2.13	1.35
90th	1.24	1.19	1.51	1.75	1.22
75th	1.11	1.07	1.17	1.26	1.10
50th	.97	.98	.92	.93	.97
25th	.89	.91	.78	.67	.89
10th	.84	.86	.69	.51	.84
Minimum	.72	.81	.58	.30	.76
Standard Deviation	.14	.12	.29	.43	.14

The percentiles and standard deviation are weighted by 1980 population.

physicians in the state with the lowest premium--Arkansas. Clearly, if the malpractice cost share were large, this degree of dispersion would imply large differences in the GMEI. Malpractice, though, has a cost share of only .056. The next most variable proxy is for office rents (cost share = 0.111). However, its standard deviation is about one-half that of malpractice premiums.

Both of the proxies for labor input price vary less than those for the nonlabor inputs. However, there is clearly more dispersion in the proxy forphysicians' own time (cost share = 0.542) than in the proxy for employee wages (cost share = 0.157). Using the range from the 10th to 90th percentiles as the measure of dispersion, the physician proxy has a range of 0.40 as compared to 0.33 for employees. This suggests that there may be greater heterogeneity across areas in professional workers than in workers used in the employee proxy. Given the relative cost shares, it is not surprising that the dispersion in the GMEI tracks the wage proxies more closely than the nonwage proxies.

To further explore how the proxies and the index vary across areas, we examined mean values of each variable by area type. Table 3 shows the results of this analysis for urban and rural areas, and MSAs of various sizes. The urban/rural comparisons show that input prices, as measured by the GMEI, are 17 percentage points higher in urban than in rural areas, largely due to the fact that urban workers, professionals and others, earn 16-17 percentage points more than their rural counterparts.

The MSA size results confirm the reasonableness of the relationship among several price proxies. Spatial economics predicts that as metropolitan areas increase in population density, land becomes scarcer and rents rise. However, as argued above, workers accept wages that do not fully offset these living cost differences in order to have access to the amenities that are available in

Table 3

Input Price Proxies and GMEI Means by Metropolitan Area Population

(1.00 = U.S. average)

Metropolitan Population	Physicians' Own Time	Employee Wages	Office Rent	Malpractice Insurance	GMEI
Urban	1.04	1.04	1.08	1.08	1.04
3+ million	1.19	1.16	1.34	1.55	1.20
1-3 million	1.05	1.05	1.11	1.10	1.05
.5-1 million	.98	.98	.98	.82	.97
.25-.5 million	.97	.97	.95	.91	.97
< .25 million	.93	.93	.88	.79	.93
Rural	.87	.88	.73	.75	.87

These means are weighted by 1980 population.

big cities. The data show clear gradients in the rent and wage proxies across MSA population size groups. For both categories of workers, the rent gradient is steeper than the wage gradient, as expected.

The data show that physicians in MSAs below 1 million population, the majority of areas, face overall input prices that are not above the national average. However, prices rise quickly with MSA size. The biggest cities have practice input prices 20 percent above the national average. Anothernoteworthy finding is that rural physicians face prices that are 6 percentage points below even those in the smallest MSAs. This suggests that urban/rural GMEI differences are not solely due to the big-city effects. It also indicates that physician fees based solely on the GMEI would result in lower payments in rural areas than even in the smallest MSAs.

A detailed tabulation of the GMEI, and its component proxies, is presented in Appendix 2. The MSAs are listed in alphabetical order, followed by rural areas of states. Alternative indices are presented in Welch, Zuckerman, and Pope (1989). Only a brief review of these GMEI values is given here. Outside of Anchorage and rural Alaska, the highest practice costs are found in two MSAs in the New York Consolidated Metropolitan Statistical Area (CMSA) - New York, NY (27.1 percent above average) and Nassau-Suffolk, NY (26.9 percent above average). The areas with the top and bottom 20 values are plausible. The top twenty are dominated by areas in or near major urban centers. Fourteen of the 20 are in MSAs located in the New York CMSA (including New Jersey and Connecticut) and California. On the other hand, 13 of the 20 lowest cost areas are rural. The remaining 7 are MSAs with populations in the 80,000 to 300,000 range. The lowest cost area, by our estimate, is Fayetteville-Springdale, AR (24.3 percent below average).

V. CONCLUSION

This paper shows that available data sources can be used to compute a geographic index of physician practice costs consistent with economic theory. The general patterns displayed by this index seem reasonable. In addition, the practice cost index accounts for nearly one-half of the variation in a geographic index of Medicare fees (Pope, Welch, Zuckerman, and Henderson, 1989). This result is consistent with the hypothesis that the index measures relative differences in the costs that physicians face across areas.

In reforming Medicare physician payments, the GMEI could be used as a geographic multiplier in association with a relative value scale for procedures. Alternatively, it could be employed to roll back fees in "overpriced" areas. However, policymakers need to be aware that any geographic index of costs used in physician payment reform will have some limitations. The GMEI presented above measures the relative cost of a fixed basket of practice inputs. It does not, however, account for possible differences in production technology or output (e.g., of rural versus urban physicians), area demand factors, or the rates paid by other third-party insurers. Moreover, while explaining the majority of geographic variation in the average level of Medicare fees, the GMEI accounts for a relatively small fraction of the variation in many individual fees, under 10 percent in some cases (Pope, Welch, Zuckerman, and Henderson, 1989). Use of the index in reimbursement would therefore entail substantial redistributions among areas in payments for some procedures. Since payment rates have important implications for the distribution of physicians and beneficiary access to care, learning more about the reasons for geographic fee patterns before applying the index is prudent.

APPENDIX 1

This appendix has two purposes: (1) To demonstrate formally that, assuming flexible prices, a necessary condition for spatial equilibrium in the physician market is that real hourly earnings are lower in high-amenity areas, and (2) to show that, under certain conditions, the Laspeyres index of practice input costs defines the same relative prices for physician services among areas as a competitive market.

I. A Simple Model of Physician Practice

Before preceding to the specific analyses, we set forth a simple model of physician behavior which underlies the remainder of the appendix. Assume physicians maximize utility, which depends on real income, leisure hours, and area amenities. Real income $I = Y/COL$, where Y is nominal income and COL is cost of living (i.e., the area price of a composite good). Leisure hours $L = T-H$ where T is total hours and H is hours worked. Area amenities are summarized in an index A. Thus

$$U = U(I,L,A);\ U_I > 0,\ U_L > 0,\ U_A > 0; \tag{A-1}$$

where subscripts denote partial derivatives. Physician output Q is produced with physician time H and other practice inputs N (for simplicity assume only one other input):

$$Q = Q(H,N) = \min[aH, bN]. \tag{A-2}$$

Production is constant returns to scale fixed proportions (Leontief) where a and b are the marginal (and average) productivities of H and N, respectively, used in fixed proportions. Cost minimization implies that $aH = bN$, or

$$N = (a/b)H. \tag{A-3}$$

The physician is a price taker facing price P for output and r for the other practice input. His/her income is therefore

$$PQ - rN = PaH - r(a/b)H = aH(P-r/b). \tag{A-4}$$

His/her average hourly income, or imputed "wage" W, is

$$W = (PQ-rN)/H = a(P-r/b) \tag{A-5}$$

which is independent of hours worked H. Income is then equal to W·H.

Define the physician's real wage, W_r, as W/COL. Physician utility can then be rewritten

$$U = U(W_r \cdot H,\ T-H,\ A) \tag{A-6}$$

The physician chooses hours worked to maximize utility. Assuming he/she can work as many hours as he/she desires at the going "wage," the first order condition is

$$U_I \cdot W_r - U_L = 0 \tag{A-7}$$

which implies that

$$W_r = U_L/U_I = MRS_{L,I} \tag{A-8}$$

where MRS is the marginal rate of substitution between leisure time and real income.

II. Real Wages and Amenities

In this section, we formally demonstrate that lower real hourly earnings in high amenity areas is a necessary condition for spatial equilibrium in the physician market, assuming that the physician can work as much as he/she wants in each area. We will analyze only the effect of amenities on the real wage W_r, not on the nominal wage W and cost of living COL separately. For a general equilibrium analysis of the separate effects, the interested reader is referred to Roback (1982).

Define the "indirect" utility function

$$V(W_r,A) = \underset{H}{\text{Max}}\ U(W_r \cdot H,\ T-H,\ A). \tag{A-9}$$

$V(W_r, A)$ gives the maximum utility that can be attained as a function of the exogenous parameters W_r and A. Its derivation assumes that actual hours worked equal desired hours worked, or, implicitly that price adjusts to clear the market for physician output. Let us demonstrate formally that V is increasing in both W_r and A. H* denotes the optimal value of H which satisfies (A-8) and U* denotes utility evaluated at H*. Now

$$\frac{\partial V}{\partial W_r} = \frac{\partial U^*}{\partial W_r} = U_I^* \left[H^* + W_r \frac{dH^*}{dW_r}\right] - U_L^* \frac{dH^*}{dW_r}. \tag{A-10}$$

But we know from (A-8) that $W_r = U_L^*/U_I^*$. Substituting in

$$\frac{\partial V}{\partial W_r} = U_I \cdot H^* + U_L^* \frac{dH^*}{dW_r} - U_L \frac{dH^*}{dW_r} = U_I^* \cdot H^* > 0. \quad \text{(A-11)}$$

Similarly, using (A-8) again,

$$\frac{\partial V}{\partial A} = U_I^* \cdot W_r \cdot \frac{dH^*}{dA} - U_L^* \frac{dH^*}{dA} + U_A^* = U_A^* > 0. \quad \text{(A-12)}$$

Now consider two areas 1 and 0 with $A_1 > A_0$. For spatial equilibrium to exist, the maximum utility attainable in each area must be equal:

$$V(W_{r1}, A_1) = V(W_{r0}, A_0). \quad \text{(A-13)}$$

Since V is increasing in A and W_r, $A_1 > A_0$ implies that $W_{r1} < W_{r0}$. The real wage must be lower in high amenity areas as a compensating differential. Migration from low-amenity to high-amenity areas will lower the relative wage in the high-amenity area until (A-13) is satisfied. However, if rigid non-market fees are set by insurers, the physicians' implicit wage will be fixed (by equation A-5) at an amount which does not provide the correct compensating differential for cost of living and amenities. In this case, spatial equilibrium is established by changes in hours worked. Thus, actual physician hourly income may not be a good measure of appropriate compensating differentials.

III. Input costs and Relative Prices

In this section, we show that adjusting physician fees from market to market by a Laspeyres index of input costs establishes the same relative prices as are set in a flexible-price spatial equilibrium, if the market-determined implicit wage for physician time is used in the input price index.

Consider two areas 1 and 0 with market-determined fees P_1 and P_0. By equation (A-5), these prices uniquely determine implicit market "wages" W_1 and W_0. Using W_1 and W_0, the Laspeyres index for an input bundle $(\bar{H},\bar{N})$ for areas 1 and 0, $I_{1,0,}$ is

$$I_{1,0} = \frac{W_1 \cdot \bar{H} + r_1 \cdot \bar{N}}{W_0 \cdot H + r_0 \cdot N}$$

Using (A-3) and (A-5), $I_{1,0}$ can be rewritten

$$I_{1,0} = \frac{W_1 \cdot \bar{H} + r_1\,(a/b) \cdot \bar{H}}{W_0 \cdot H + r_0\,(a/b) \cdot H} = \frac{W_1 + (a/b)\,r_1}{W_0 + (a/b)\,r_0} \qquad \text{(A-15)}$$

$$= \frac{aP_1 - (a/b)r_1 + (a/b)r_1}{aP_0 - (a/b)r_0 + (a/b)r_0} = P_1/P_0 \,.$$

Thus, under the assumptions made here, if the Laspeyres input price index incorporates the market-determined implicit physician wage, it accurately measures the ratio of market prices between areas.

Appendix 2: Input Price Proxies

By MSA and Rural Area of States:

In Alphabetical Order

MSA Code	Name	GMEI
40	ABILENE, TX	0.860
80	AKRON, OH	0.965
120	ALBANY, GA	0.897
160	ALBANY-SCHENECTADY-TROY, NY	1.000
200	ALBUQUERQUE, NM	0.946
220	ALEXANDRIA, LA	0.913
240	ALLENTOWN-BETHLEHEM, PA-NJ	0.970
280	ALTOONA, PA	0.871
320	AMARILLO, TX	0.872
360	ANAHEIM-SANTA ANA,CA	1.209
380	ANCHORAGE, AK	1.354
400	ANDERSON, IN	0.924
405	ANDERSON, SC	0.855
440	ANN ARBOR, MI	1.040
450	ANNISTON, AL	0.889
460	APPLETON-OSHKOSH-NEENAH, WI	0.925
480	ASHEVILLE, NC	0.832
500	ATHENS, GA	0.843
520	ATLANTA, GA	0.942
560	ATLANTIC CITY, NJ	1.055
600	AUGUSTA, GA-SC	0.875
620	AURORA-ELGIN, IL	1.009
640	AUSTIN, TX	0.891
680	BAKERSFIELD, CA	1.102
720	BALTIMORE, MD	1.074
733	BANGOR, ME	0.846
760	BATON ROUGE, LA	0.956
780	BATTLE CREEK, MI	1.049
840	BEAUMONT-PORT ARTHUR, TX	0.949
845	BEAVER COUNTY, PA	0.962
860	BELLINGHAM, WA	0.999
870	BENTON HARBOR, MI	0.948
875	BERGEN-PASSAIC, NJ	1.150
880	BILLINGS, MT	0.931
920	BILOXI-GULFPORT, MS	0.896
960	BINGHAMTON, NY	0.940
1000	BIRMINGHAM, AL	0.914
1010	BISMARK, ND	0.920
1020	BLOOMINGTON, IN	0.829
1040	BLOOMINGTON-NORMAL, IL	0.994
1080	BOISE CITY,IDAHO	0.939
1123	BOSTON-LOWELL-BROCKTON-LAWRENCE	1.076
1125	BOULDER-LONGMONT, CO	0.957
1140	BRADENTON, FL	0.902
1145	BRAZORIA, TX	1.009
1150	BREMERTON, WA	1.088
1163	BRIDGEPORT-STAMFORD-NORWALK-DAN	1.196
1240	BROWNSVILLE-HARLINGEN, TX	0.885
1260	BRYAN-COLLEGE STATION, TX	0.905
1280	BUFFALO, NY	0.996
1300	BURLINGTON, NC	0.867
1303	BURLINGTON, VT	0.893
1320	CANTON, OH	0.942
1350	CASPER, WY	1.051
1360	CEDAR RAPIDS, IA	0.934
1400	CHAMPAIGN-URBANA-RANTOUL, IL	0.892
1440	CHARLESTON, SC	0.882

MSA Code	Name	GMEI
1480	CHARLESTON, WV	0.975
1520	CHARLOTTE-GASTONIA-ROCK HILL, N	0.884
1540	CHARLOTTESVILLE, VA	0.867
1560	CHATTANOOGA, TN-GA	0.882
1580	CHEYENNE, WY	0.975
1600	CHICAGO, IL	1.184
1620	CHICO, CA	0.994
1640	CINCINNATI, OH-KY-IN	0.954
1660	CLARKSVILLE-HOPKINSVILL, TN-KY	0.839
1680	CLEVELAND, OH	1.027
1720	COLORADO SPRINGS, CO	0.922
1740	COLUMBIA, MO	0.866
1760	COLUMBIA, SC	0.873
1800	COLUMBUS, GA-AL	0.832
1840	COLUMBUS, OH	0.941
1880	CORPUS CHRISTI, TX	0.899
1900	CUMBERLAND,MD-W VA	0.891
1920	DALLAS, TX	0.952
1950	DANVILLE, VA	0.877
1960	DAVENPORT-ROCK ISLAND-MOLINE, I	0.991
2000	DAYTON-SPRINGFIELD, OH	0.981
2020	DAYTONA BEACH, FL	0.931
2040	DECATUR, IL	0.970
2080	DENVER, CO	1.037
2120	DES MOINES, IA	0.961
2160	DETROIT, MI	1.216
2180	DOTHAN, AL	0.871
2200	DUBUQUE, IA	0.886
2240	DULUTH, MN-WI	0.957
2290	EAU CLAIRE, WI	0.913
2320	EL PASO, TX	0.918
2330	ELKHART-GOSHEN, IN	0.920
2335	ELMIRA, NY	0.945
2340	ENID, OK	0.842
2360	ERIE, PA	0.938
2400	EUGENE-SPRINGFIELD, OR	0.932
2440	EVANSVILLE, IN-KY	0.911
2520	FARGO-MOORHEAD, ND-MN	0.896
2560	FAYETTEVILLE, NC	0.883
2580	FAYETTEVILLE-SPRINGDALE, AR	0.757
2640	FLINT, MI	1.126
2650	FLORENCE, AL	0.932
2655	FLORENCE, SC	0.864
2670	FORT COLLINS-LOVELAND, CO	0.915
2680	FORT LAUDERDALE-HOLLYWOOD-POMPA	1.025
2700	FORT MYERS-CAPE CORAL, FL	0.961
2710	FORT PIERCE, FL	0.955
2720	FORT SMITH, AR-OK	0.833
2750	FORT WALTON BEACH, FL	0.890
2760	FORT WAYNE, IN	0.936
2800	FORT WORTH-ARLINGTON, TX	0.888
2840	FRESNO, CA	1.043
2880	GADSDEN, AL	0.873
2900	GAINESVILLE, FL	0.898
2920	GALVESTON-TEXAS CITY, TX	0.921
2960	GARY-HAMMOND, IN	1.017
2975	GLENS FALLS, NY	0.942

MSA Code	Name	GMEI
2985	GRAND FORKS, ND	0.879
3000	GRAND RAPIDS, MI	1.004
3040	GREAT FALLS, MT	0.929
3060	GREELEY, CO	0.886
3080	GREEN BAY, WI	0.941
3120	GREENSBORO-WINSTON-SALEM-HIGH P	0.879
3160	GREENVILLE-SPARTANBURG, SC	0.868
3180	HAGERSTOWN, MD	0.935
3200	HAMILTON-MIDDLETOWN, OH	0.961
3240	HARRISBURG-LEBANON-CARLISE, PA	0.968
3283	HARTFORD-MIDDLETOWN-NEW BRITAIN	1.049
3290	HICKORY, NC	0.800
3320	HONOLULU, HI	1.055
3350	HOUMA-THIBODAUX,LA	0.912
3360	HOUSTON, TX	1.004
3400	HUNTINGTON-ASHLAND,WV-KY-OH	0.906
3440	HUNTSVILLE, AL	0.930
3480	INDIANAPOLIS, IN	0.950
3500	IOWA CITY, IA	0.881
3520	JACKSON, MI	1.052
3560	JACKSON, MS	0.879
3580	JACKSON, TN	0.873
3600	JACKSONVILLE, FL	0.945
3605	JACKSONVILLE, NC	0.867
3620	JANESVILLE-BELOIT, WI	0.923
3640	JERSEY CITY, NJ	1.116
3660	JOHNSON CITY-KINGSPORT-BRISTOL,	0.876
3680	JOHNSTOWN, PA	0.931
3690	JOLIET, IL	1.065
3710	JOPLIN, MO	0.893
3720	KALAMAZOO, MI	1.038
3740	KANKAKEE, IL	0.924
3760	KANSAS CITY, MO-KS	0.948
3800	KENOSHA, WI	0.961
3810	KILLEEN-TEMPLE, TX	0.859
3840	KNOXVILLE, TN	0.855
3850	KOKOMO, IN	0.980
3870	LA CROSSE, WI	0.867
3920	LAFAYETTE, IN	0.850
3880	LAFAYETTE, LA	0.943
3960	LAKE CHARLES, LA	0.897
3965	LAKE COUNTY, IL	1.076
4000	LANCASTER, PA	0.925
4040	LANSING-EAST LANSING, MI	1.013
4080	LAREDO, TX	0.845
4100	LAS CRUCES, NM	0.874
4120	LAS VEGAS, NV	1.120
4150	LAWRENCE, KS	0.832
4200	LAWTON, OK	0.865
4243	LEWISTON-AUBURN, ME	0.803
4280	LEXINGTON-FAYETTE, KY	0.884
4320	LIMA, OH	0.910
4360	LINCOLN, NE	0.853
4400	LITTLE ROCK-NORTH LITTLE ROCK,	0.884
4420	LONGVIEW-MARSHALL, TX	0.873
4440	LORAIN-ELYRIA, OH	0.950
4520	LOUISVILLE, KY-IN	0.927
4600	LUBBOCK, TX	0.816

MSA Code	Name	GMEI
4640	LYNCHBURG, VA	0.838
4680	MACON-WARNER ROBINS, GA	0.857
4720	MADISON, WI	0.922
4763	MANCHESTER-NASHUA, NH	0.927
4800	MANSFIELD, OH	0.903
4880	MCALLEN-EDINBURG-MISSION, TX	0.802
4890	MEDFORD, OR	0.940
4900	MELBOURNE-TITUSVILLE, FL	0.940
4920	MEMPHIS, TN-AR-MS	0.876
4940	MERCED, CA	1.064
5000	MIAMI-HIALEAH, FL	1.130
5015	MIDDLESEX-SOMERSET-HUNTERDON, N	1.162
5040	MIDLAND, TX	1.020
5080	MILWAUKEE, WI	1.000
5120	MINNEAPOLIS-ST PAUL, MN-WI	1.039
5160	MOBILE, AL	0.877
5170	MODESTO, CA	1.065
5190	MONMOUTH-OCEAN, NJ	1.128
5200	MONROE, LA	0.896
5240	MONTGOMERY, AL	0.904
5280	MUNCIE, IN	0.893
5320	MUSKEGON, MI	0.997
5345	NAPLES, FL	1.018
5360	NASHVILLE, TN	0.899
5380	NASSAU-SUFFOLK, NY	1.269
5403	NEW BEDFORD-FALL RIVER-ATTLEBOR	0.963
5483	NEW HAVEN-WEST HAVEN-WATERBURY-	1.018
5523	NEW LONDON-NORWICH, CT-RI	1.021
5560	NEW ORLEANS, LA	1.002
5600	NEW YORK, NY	1.279
5640	NEWARK, NJ	1.156
5700	NIAGARA FALLS, NY	1.010
5720	NORFOLK-VIRGINIA BEACH-NEWPORT	0.914
5775	OAKLAND, CA	1.186
5790	OCALA, FL	0.844
5800	ODESSA, TX	0.978
5880	OKLAHOMA CITY, OK	0.891
5910	OLYMPIA, WA	1.068
5920	OMAHA, NE-IA	0.888
5950	ORANGE COUNTY, NY	1.041
5960	ORLANDO, FL	0.962
5990	OWENSBORO, KY	0.893
6000	OXNARD-VENTURA, CA	1.147
6015	PANAMA CITY, FL	0.903
6020	PARKERSBURG-MARIETTA, WV-OH	0.885
6025	PASCAGOULA, MS	0.874
6080	PENSACOLA, FL	0.906
6120	PEORIA, IL	1.049
6160	PHILADELPHIA, PA-NJ	1.097
6200	PHOENIX, AZ	1.027
6240	PINE BLUFF, AR	0.817
6280	PITTSBURGH, PA	1.010
6323	PITTSFIELD, MA	0.979
6403	PORTLAND, ME	0.916
6440	PORTLAND, OR	0.995
6453	PORTSMOUTH-DOVER-ROCHESTER,NH	0.934
6460	POUGHKEEPSIE, NY	1.092

MSA Code	Name	GMEI
6483	PROVIDENCE-PAWTUCKET-WOONSOCKET	1.006
6520	PROVO-OREM, UT	0.917
6560	PUEBLO, CO	1.039
6600	RACINE, WI	1.042
6640	RALEIGH-DURHAM, NC	0.892
6660	RAPID CITY, SD	0.871
6680	READING, PA	0.966
6690	REDDING, CA	1.076
6720	RENO, NV	1.105
6740	RICHLAND-KENNEWICK, WA	1.039
6760	RICHMOND-PETERSBURG, VA	0.903
6780	RIVERSIDE-SAN BERNARDINO,CA	1.110
6800	ROANOKE, VA	0.894
6820	ROCHESTER, MN	0.983
6840	ROCHESTER, NY	1.059
6880	ROCKFORD, IL	0.976
6920	SACRAMENTO, CA	1.119
6960	SAGINAW-BAY CITY-MIDLAND, MI	1.083
7080	SALEM, OR	0.941
7120	SALINAS-SEASIDE-MONTEREY, CA	1.133
7160	SALT LAKE CITY-OGDEN, UT	0.960
7200	SAN ANGELO, TX	0.833
7240	SAN ANTONIO, TX	0.884
7320	SAN DIEGO, CA	1.119
7360	SAN FRANCISCO, CA	1.224
7400	SAN JOSE, CA	1.240
7480	SANTA BARBARA-SANTA MARIA-LOMPO	1.117
7485	SANTA CRUZ, CA	1.100
7490	SANTA FE, NM	0.988
7500	SANTA ROSA-PETALUMA, CA	1.102
7510	SARASOTA, FL	0.962
7520	SAVANNAH, GA	0.876
7560	SCRANTON-WILKES BARRE, PA	0.910
7600	SEATTLE, WA	1.065
7610	SHARON,PA	0.942
7620	SHEBOYGAN, WI	0.894
7640	SHERMAN-DENISON, TX	0.855
7680	SHREVEPORT, LA	0.971
7720	SIOUX CITY, IA-NE	0.929
7760	SIOUX FALLS, SD	0.868
7800	SOUTH BEND-MISHAWAKA, IN	0.893
7840	SPOKANE, WA	0.974
7880	SPRINGFIELD, IL	1.001
7920	SPRINGFIELD, MO	0.874
8003	SPRINGFIELD,MA	0.956
6980	ST CLOUD, MN	0.913
7000	ST JOSEPH, MO	0.848
7040	ST LOUIS, MO-IL	0.998
8050	STATE COLLEGE,PA	0.935
8080	STEUBENVILLE-WEIRTON, OH-WV	0.938
8120	STOCKTON, CA	1.089
8160	SYRACUSE, NY	0.969
8200	TACOMA, WA	1.041
8240	TALLAHASSEE, FL	0.888
8280	TAMPA-ST. PETERSBURG-CLEAR, FL	0.913
8320	TERRE HAUTE, IN	0.855
8360	TEXARKANA, TX-TEXARKANA, AR	0.824
8400	TOLEDO, OH	0.975

MSA Code	Name	GMEI
8440	TOPEKA, KS	0.875
8480	TRENTON, NJ	1.122
8520	TUCSON, AZ	0.981
8560	TULSA, OK	0.918
8600	TUSCALOOSA, AL	0.863
8640	TYLER, TX	0.911
8680	UTICA-ROME, NY	0.926
8720	VALLEJO-FAIRFIELD-NAPA, CA	1.062
8725	VANCOUVER, WA	1.012
8750	VICTORIA, TX	0.910
8760	VINELAND-MILLVILLE-BRIDGETON, N	0.972
8780	VISALIA-TULARE-PORTERVILLE, CA	1.024
8800	WACO, TX	0.878
8840	WASHINGTON, D C -MD-VA	1.191
8920	WATERLOO-CEDAR FALLS, IA	0.935
8940	WAUSAU, WI	0.926
8960	WEST PALM BEACH-BOCA RATON-DELR	0.990
9000	WHEELING, WV-OH	0.927
9080	WICHITA FALLS, TX	0.863
9040	WICHITA, KS	0.924
9140	WILLIAMSPORT, PA	0.914
9160	WILMINGTON, DE-NJ-MD	1.103
9200	WILMINGTON, NC	0.856
9243	WORCESTER-FITCHBURG-LEOMINSTER,	0.982
9260	YAKIMA, WA	1.004
9280	YORK, PA	0.929
9320	YOUNGSTOWN-WARREN, OH	0.954
9340	YUBA CITY, CA	1.028

MSA Code	Name	GMEI
9901	Alabama	0.864
9902	Alaska	1.322
9904	Arizona	0.942
9905	Arkansas	0.796
9906	California	0.998
9908	Colorado	0.877
9909	Connecticut	0.976
9910	Delaware	0.925
9912	Florida	0.863
9913	Georgia	0.820
9915	Hawaii	1.010
9916	Idaho	0.884
9917	Illinois	0.910
9918	Indiana	0.870
9919	Iowa	0.851
9920	Kansas	0.807
9921	Kentucky	0.859
9922	Louisiana	0.853
9923	Maine	0.827
9924	Maryland	0.927
9925	Massachusetts	0.952
9926	Michigan	0.949
9927	Minnesota	0.884
9928	Mississippi	0.822
9929	Missouri	0.826
9930	Montana	0.869
9931	Nebraska	0.799
9932	Nevada	0.985
9933	New Hampshire	0.856
9935	New Mexico	0.895
9936	New York	0.914
9937	North Carolina	0.812
9938	North Dakota	0.845
9939	Ohio	0.891
9940	Oklahama	0.836
9941	Oregon	0.930
9942	Pennsylvania	0.908
9944	Rhode Island	0.980
9945	South Carolina	0.829
9946	South Dakota	0.800
9947	Tennessee	0.820
9948	Texas	0.821
9949	Utah	0.946
9950	Vermont	0.804
9951	Virginia	0.842
9953	Washington	0.956
9954	West Virginia	0.845
9955	Wisconsin	0.849
9956	Wyoming	0.892

Note: State values shown are for rural areas.

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